

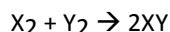
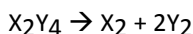
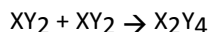
T16D08 – 16.2/3 HL IB Review

Name.....

1. The activation energy, of a reaction can be obtained from the rate constant, k , and the absolute temperature, T . Which graph of these quantities produces a straight line?

- A. k against T
B. k against $\frac{1}{T}$
C. $\ln k$ against T
D. $\ln k$ against $\frac{1}{T}$

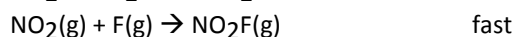
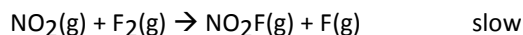
2. The mechanism of a reaction is



What is the overall equation for the reaction?

- A. $X_2Y_4 \rightarrow 2XY_2$
B. $2XY_2 \rightarrow X_2 + 2Y_2$
C. $2XY_2 \rightarrow 2XY + Y_2$
D. $X_2Y_4 \rightarrow 2XY + Y_2$

3. For the reaction $2NO_2(g) + F_2(g) \rightarrow 2NO_2F(g)$ the accepted mechanism is



What is the rate expression for this reaction?

- A. $\text{rate} = k[NO_2]^2[F_2]$
B. $\text{rate} = k[NO_2][F_2]$
C. $\text{rate} = k[NO_2][F]$
D. $\text{rate} = k[NO_2]^2$

4. (a) The variation of the rate constant, k , for a reaction with temperature is shown by the Arrhenius equation. Two versions of this equation are shown in Table 1 of the Data Booklet.

(i) Explain the significance of the Arrhenius constant, A , in this equation.

(1)

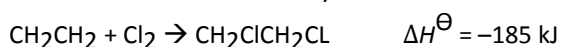
(ii) Explain what is meant by the term *activation energy*, E_a .

(1)

(iii) Describe how, using a graphical method, values of A and E_a can be obtained for a reaction.

(5)

- (b) The equation for a reaction used in industry is



Iron(III) chloride can be used as a catalyst for the reaction.

- (i) Explain the difference between the terms *homogeneous* and *heterogeneous* when applied to a catalyst.

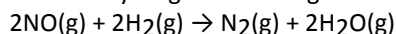
(1)

- (ii) Draw an enthalpy level diagram for this reaction, including labels for ΔH^\ominus , E_a and the activation energy when a catalyst is used, E_{cat} .

(4)

(Total 12 marks)

5. Nitrogen(II) oxide reacts with hydrogen according to the following equation:



The table shows how the rate of reaction varies as the concentrations of the reactants are changed.

Experiment	Initial [NO] / mol dm ⁻³	Initial [H ₂] / mol dm ⁻³	Initial rate / mol (N ₂) dm ⁻³ s ⁻¹
1	0.100	0.100	253 × 10 ⁻⁶
2	0.100	0.200	5.05 × 10 ⁻⁶
3	0.200	0.100	1.01 × 10 ⁻⁵
4	0.300	0.100	2.28 × 10 ⁻⁵

- (a) Determine the order of reaction with respect to H₂ and with respect to NO.

H₂

NO

(2)

- (b) Write the rate expression for the reaction.

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(1)

- (c) Calculate the value for the rate constant, and state its units using the data from experiment 1.

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(2)

- (d) A suggested mechanism for this reaction is as follows.



State and explain whether this mechanism agrees with the experimental rate expression in (b).

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(4)

- (e) Explain why a single step mechanism is unlikely for a reaction of this kind.

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(2)

- (f) Deduce and explain how the initial rate of formation of H₂O compares with that of N₂.

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(2) (Total 13 marks)